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Letter to the Editor

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ABSTRACT

The paper discusses the need of renewable energy sources. A case study has been carried out to study the technical state of art, reasons for the plant becoming non-operative, revival opportunities with justification and finally comes out with recommendations to revive on the basis of comprehensive survey conducted in the village. The case study is carried out at Nayakana Hulikatti village in Dharwad district that was developed by IEI (International Energy Initiative) in 1995–96 in co-ordination with rotary club and the plant was functional for few years. The paper also highlights the need of educating consumers to involve in power generation using locally available renewable resources for their power requirement.

Revival opportunities of community monitored biogas plant

1. Introduction

Water supply and electricity in India's rural areas is the immediate requirement. In the present power scenario, it is becoming difficult to supply power from central grid to consumers residing in rural/remote areas. In view of energy shortage, they cannot be deprived of energy comforts. However they need to be educated about the use of locally available resources that are renewable in nature. The use of renewables for power generation [1,2] can be locally managed and operated in villages. Further it allows the users to participate and also avoids inherent losses, if power would be delivered from centralized system. Hence, village-based biogas power plant could be more sustainable and appropriate. The common forms of bio-gas are animal dung, crop products, crop wastes, wood, etc.

Bio-gas is a mixture of methane and carbon dioxide (in the ratio 3:2) produced by the anaerobic fermentation of cellulosic material like animal dung. Bio-gas technology has been in use in India for decades and concerted efforts have been put in for its promotion. Very few community village level bio-gas plants are successful in generation [3–9]. IEI developed community based biogas plants in nine villages in Karnataka in the year 1995 in co-ordination with Govt., NGOs and rotary clubs, for REWSU (Rural Electricity and Water Supply Utility). One such village is Nayakan Hulikatti in Dharwad district [10]. The village was provided with dual-fuel engine-generator set and village wide distribution system to supply power. Further the generation was used to fuel water pump from which water was supplied to individual houses besides lighting points in each house. However, smooth operation did not take place for quite a few reasons despite IEI's financial support. In this connection survey is carried out to know the reasons. The details of the plant and related issues are presented as a case study.

2. Case study

The case study here includes two components. The first component is the household survey followed by the data analysis to assess and reassert the potential availability and technical details of the existing plant. The second component includes the opinion of the people, recommendations for the revival opportunities. In order to assess the total energy needs of the village, it initiated a household survey. Since 1996 only 5% of the village extension has taken place. The household survey was conducted by interviewing 126 people from 88 households of the village with a comprehensively proposed questionnaire [1]. The questionnaire consisted of two parts, one for the individual households and the other for the village as a whole. The details of data compilation and analysis from the survey are discussed in the following sub-sections.

2.1. Socio-economic status

The total population of the village is currently 828 and their educational levels are given in Table 1.

The total income earned during the year 2010 by the entire village reported to be about Rs. 12.5 lacs. Most of the households own less than two acres of land and the land holding pattern is tabulated in Table 2.

The source of fuel for bio-gas plant is animal dung and the number cattle and households are tabulated in Table 3.

To asses the power requirement the appliances with ratings and number of all households are tabulated in Table 4. This helps to know the demand for electrical energy.

2.2. Electricity connections

The state government launched a scheme called Bhagyajyothi and Kutirjyothi to supply power for lighting to villages at reasonable tariff. This facility was availed by many households. The electricity connection pattern of the village is shown in Table 5.

About 1% of the household do not have electricity connection and this is because of unsuitable house structure and/or inability to pay electricity bills. About 55% of households are provided power under Bhagyajyothi and/or Kutirjyothi scheme. This made villagers to think that power would be supplied to them at no cost. Hence the electricity bill payment is quite erratic and haphazard. The average monthly electricity bills are tabulated in Table 6.

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Table 1
Education levels in the village.

Level passed	Number of people
Lower primary	36
Higher primary	40
High school	72
Pre-University	44
Degree	4
Illiterate	508
Children studying	124
Total	828

Table 2
Land holding pattern.

Group	Land owned	House hold
Landless	–	28
Small farmers	Less than 2 acres	24
Medium farmers	2–6 acres	20
Large farmers	More than 6 acres	16

Table 3
Cattle population.

Number of cattle owned	Number of households
0	20
1	8
2	4
3	12
4	08
5	16
6 and above	20

Table 4
Energy demand.

Type of appliances	Total no. of appliances
60 W bulb	196
Fluorescent tube lights	72
Fans	20
Television	52
Iron box	8
Mixer/grinder	28
Refrigerator	4
CFL	16

2.3. Water supply requirements

Earlier people had to travel 500–800 m for domestic water requirements. Now water supply is made using pump operated by the grid supply. About 90% of the people opined that water supply could be taken up by the bio-gas plant and about 95% people expressed their satisfaction towards existing water supply services.

Table 5
Electricity connection pattern.

Type of connection from state grid	Number of household	Average monthly bill (Rs)
Domestic	38	80–85/–
Bhagya/kutirjyothi (domestic lower income special schemes)	48	40–45/–
Illegal	–	–
Un-electrified (no connection)	2	–

Table 6
Average monthly electricity bill.

Range in (Rs)	Number of Households
40–50	40
50–60	16
60–80	4
80–100	16
100–150	12

2.4. Agricultural

About 9% of households own IP sets and all of them are not satisfied with the power supplied to their IP sets. They would be much obliged, if the supply is given for at least 6 h during day time for IP sets.

2.5. Performance of the bio-gas plant

The bio-gas plant performed nearly 1 to 1½ years without any problems. This floating drum bio-gas plant has the capacity of 40 m^3 (IEI 1998). It would need 300 kg [1,11–14] of animal dung to produce 40 m^3 gas every day and is capable of running 4.4 kW diesel generator set nearly for 12 h. The people expressed their satisfaction about the plant performance when the plant was in operation. The average fuel consumption of bio-gas plant employing diesel-engine plant is shown in Fig. 1.

2.6. Potential availability

Analysis of the fuel data made it very clear that the existing plant can be run effectively for 10–12 h in a day. The dung availability and the possible power potential, if the plant is revived is shown in Fig. 2.

The power supply to villages is changing regularly depending on the availability of power. They are getting power only for 4–5 h for lighting and IP sets. The power consumption pattern and the actual demand for energy are as shown in Fig. 3.

The financial aspects of the plant operation upon revival and the cost of energy [15], if the entire village would use grid supply are as shown in Fig. 4. Thus the cost comparison is helpful in reasserting the revival.

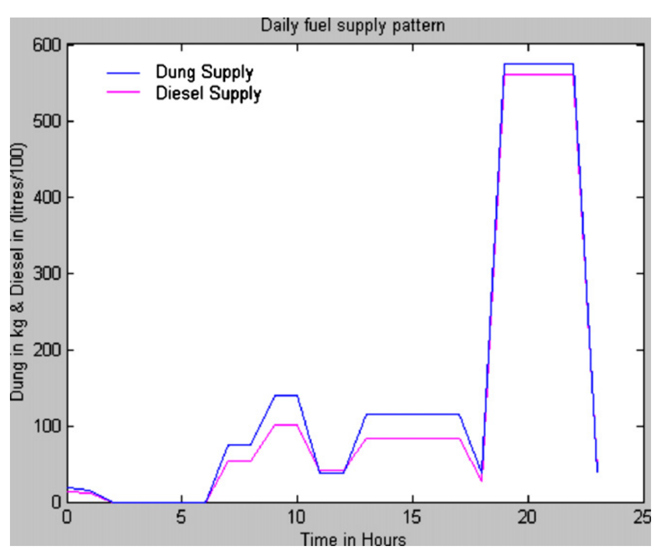


Fig. 1. Fuel consumption pattern of bio-gas plant.

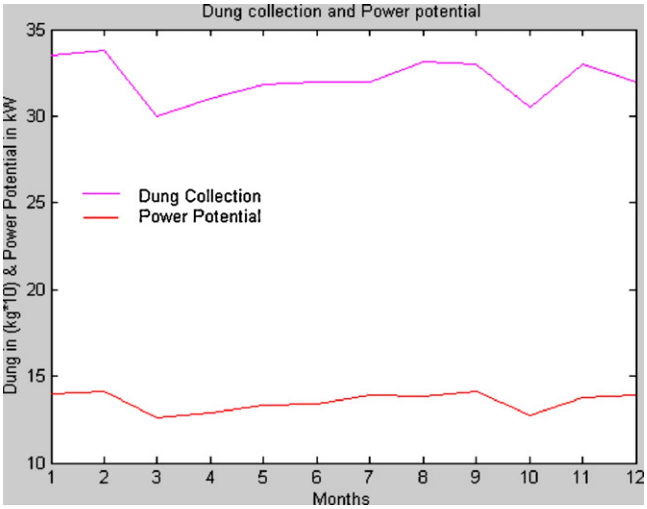


Fig. 2. Dung availability and power potential.

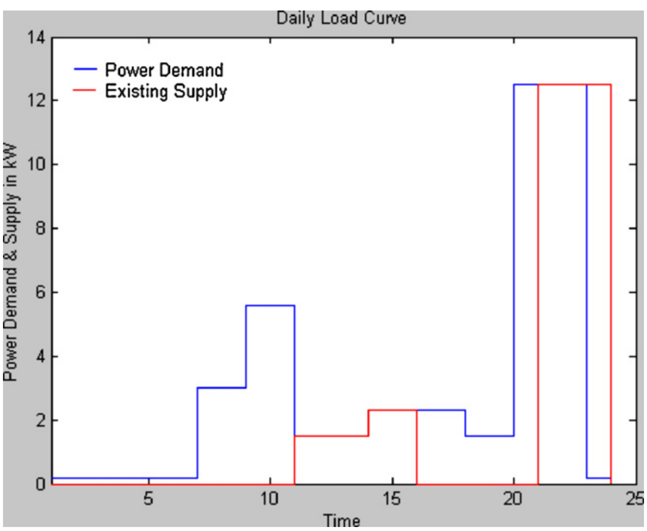


Fig. 3. Power supply and demand curves.

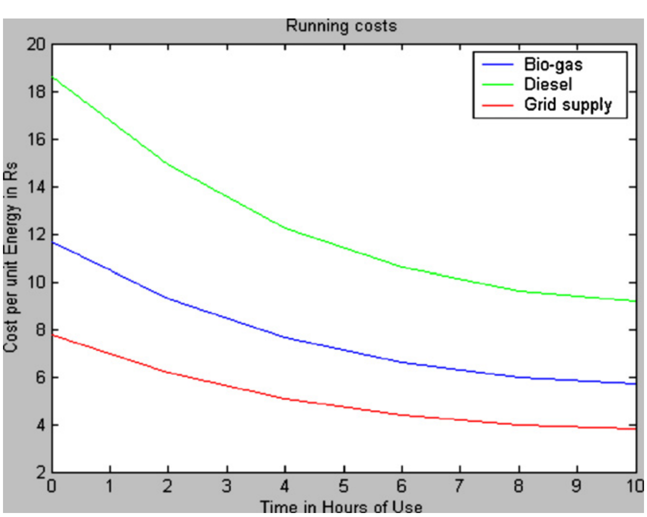


Fig. 4. Cost comparison.

3. Result analysis

From the discussions and interaction held with villagers and based on the data analysis the following results are discussed besides few reasons for the system becoming non-operative.

3.1. Technical state of art

The plant is of dual-fuel system. All the machines in the plant are intact and are in good condition. With minimum servicing, the plant operation can be resumed. The plant uses proven technology, however may need minor modification for optimization of some parameters. Since the plant is not in use for about 10 years, the control panel needs to be reinstallation. The specifications of the machinery in the plant are as given below.

Engine details: Kirloskar make, 6 bhp, 4.4 kW, 1500 rpm.
Generator details: Kirloskar make, 3-phase, 50 Hz, 415 V, star connected, 0.8 pf. Excitation-dc 240 V, 1.7 A.

3.2. Reasons for plant becoming non operative

From the discussions and interaction held with villagers, few reasons for the system becoming non-operative are derived.

- Initial enthusiasm dampened over time.
- People were under the impression that it is Govt. launched project and power supply is at free of cost. Further tariff collection was difficult because it was viewed as public service. This affected running and routine maintenance.
- The cost of energy was marginally high.
- The fluctuations in the diesel price resulted in to floating cost of energy.
- It seems the training imparted to operators is inadequate.
- Few people were unwilling to shoulder responsibility.
- Local politics resulted in to differences between groups.
- When grid supply was given, people became casual about the plant.

3.3. Opportunities for revival

- The data analysis reveals that there exists enough potential for power.
- The genuine energy demand can be met by the plant.
- Since the implemented technology was found to be satisfactorily functioning, only minimum effort is required to restart the plant.
- Government is always keen to initiate use of renewable.
- Permissible subsidy can be availed.
- Above all, to demonstrate the renewables as source of sustainable energy for the people in the close vicinity.

3.4. Justification

The attitude of the people for revival of the plant is found to be positive which is clear from their opinion. Their inclination towards the revival is asserted by their response for the questions posed to them and is as enumerated below.

- People not satisfied with present pattern of power supply from grid—98%
- House holds using kerosene and wood for cooking—50%
- People aware of solar and biomass—38%
- Households owning biogas—1%
- Households wished to have biogas plant for

Only lighting	22%
Lighting and water supply	41%
Only for IP sets	9%
Lighting, Water supply and IP sets.	10%
Not specific	18%

- People wished to have power from biogas plant when the grid supply is not available—41%
- People wished to have power only from biogas—51%
- Duration of power requirement by the people

Range in hours	Number of households
1–4	36
5–10	28
12–24	24

- Households ready for extending cooperation if the plant is revived—91%
- Households not ready for cooperation, if the plant is revived—4.5%
- Households can't say—4.5%
- Households suggested to manage plant by

People (Community)	14%
Grampanchayat	22%
Appointing permanent skilled staff	64%

- Households ready

To pay tariff	50%
To have free power	48%
For both	2%

- Opinion about having RES scheme

Agree	91%
Disagree	4.5%
Can't say	4.5%

Since the conventional sources are depleting at faster rate, biomass is a promising alternative for sustainable energy. To create awareness among the society, such plants need to be functional. The generation was abandoned due to certain reasons. The time required for its recommissioning is less and is with minimum expenses. Hence it is to be revived to signal the community about the importance and inevitability of renewables.

3.5. Inferences

The IEI initiated REWSU project is a milestone in energy field. In the present power scenario, it is necessary to come up with viable technology in biogas generation. Since it is renewable in nature will give sustainable energy. Based on the survey data analysis and opinion of the people the following recommendations are made.

- The existing plant capacity is sufficient to supply lighting load and water supply service. Hence the plant may be revived.
- For successful operation, a permanent skilled staff is to be employed.
- The existing distribution system can be used.
- The plant machinery and switching control panels are to be overhauled.
- Once the plant is commissioned, strict measures to be taken for dung supply and tariff collection.
- This will become a demonstration project to send strong signal to the society in making RES schemes more popular.
- Technical guidance from the nearby technical institutions may be taken.
- Further, it may be open for modernization.

4. Conclusion

The survey data analysis reveals that people have realized the need of biomass plant for their energy requirements. The significance of such scheme is to be made known by reassertion. Hence good number of demonstrative working models must be set up, so that people who can afford to develop their own plants in the close vicinity can be getting motivated by visiting the working plants. The energy requirement of the village can be met by the successful participation of the community. This will convey a strong message, how to become self reliant towards sustainable energy. The state of art and the condition of the plant are conducive to bring it back in action with minimum investment. This will lead further to develop hybrid grid involving more renewables.

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